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OPERATING MANUAL
for
DATRON MODEL 1057a
DIGITAL MULTIMETER

METEOR CLOSE
NORWICH AIRPORT INDUSTRIAL ESTATE NORWICH NR6 6HQ ENGLAND

MP MASTER
MA23500

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OPERATING MANUAL
for
DATRON MODEL 1057a
DIGITAL MULTIMETER
(FOR CALIBRATION & MAINTENANCE PROCEDURES
REFER TO SERVICING MANUAL)

Instrument Designed and Manufactured by:–
DATRON ELECTRONICS LTD.,
METEOR CLOSE,
NORWICH AIRPORT INDUSTRIAL ESTATE,
NORWICH, NR6 6HQ.
Telephone: 0603 412126

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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

The Model 1057a is a digital multimeter combining the high performance of a sophisticated DVM with the low cost of a conventional multimeter. Within the main frame is provided full D.C. voltage measurement capability, true R.M.S. A.C. measurement and resistance measurement.

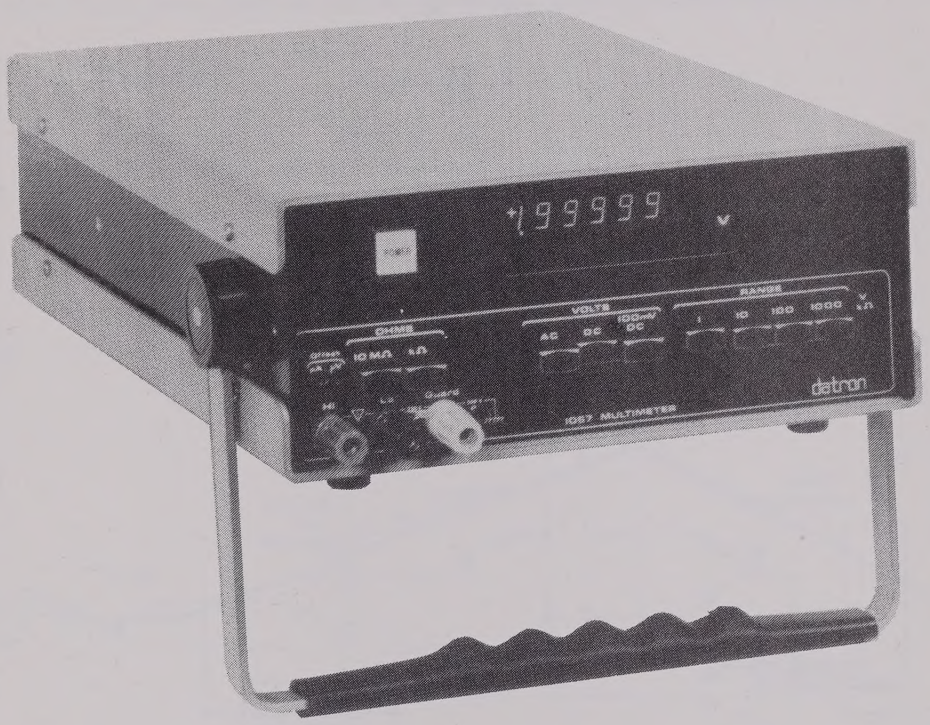

FIG. 1:1 1057a DIGITAL MULTIMETER

1.2 FUNCTIONS AND FACILITIES

1.2.1 Voltage Measurement

This instrument comprises a precision fully floating isolation amplifier with electronically switched gain ranges providing a 1 volt full range output which is converted to a digital reading by the analogue to digital converter. A.C. voltage measurement is achieved using a true R.M.S. A.C. converter which converts A.C. signals to D.C. and applies the D.C. to the analogue to digital converter. The input to the A.C. converter can be either A.C. or D.C. coupled.

1.2.2 Resistance Measurement

Resistance measurement is achieved by passing the current from a precision current source through the unknown resistance and sensing the voltage developed across that unknown with the D.C. isolation amplifier.

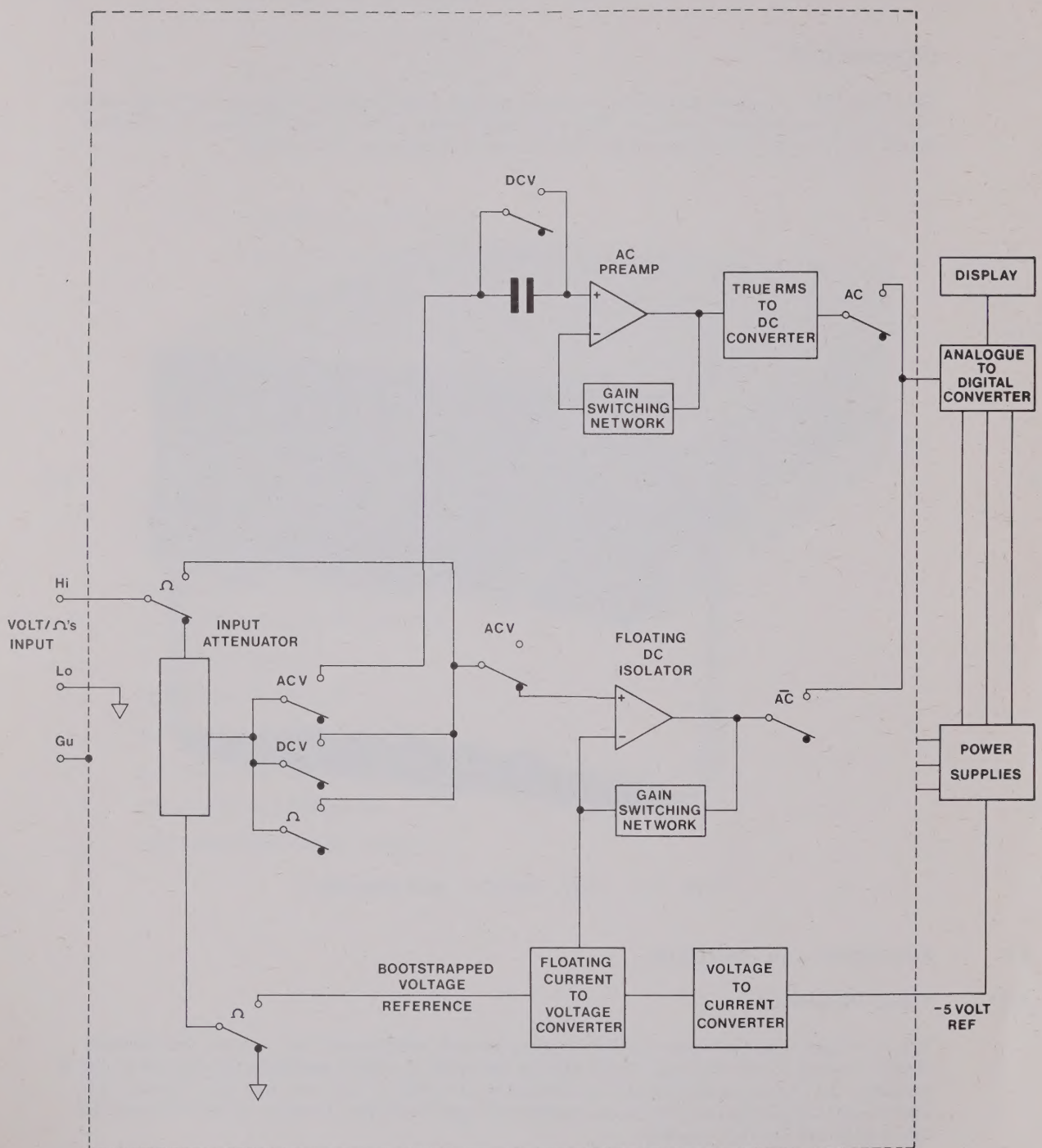

FIG. 1.2
SIMPLIFIED BLOCK DIAGRAM

1.3 GENERAL ELECTRICAL DESCRIPTION

For a detailed electrical description, maintenance and repair procedures, component kits and circuit diagrams, refer to the Servicing Manual, 850036.

The analogue to digital conversion technique used converts the signal from the D.C. isolator into a time period directly proportional to the input voltage. The D.C. Isolator output is a 0 to 1V signal which is amplified by a factor of 5 and then applied via electronic switching to the input of a high-gain integration amplifier. The integration capacitor starts charging from a zero state at a rate proportional to the input voltage. The integration period lasts for approximately 20mS during which time the capacitor acquires a charge proportional to $V_{in.}$

At the end of 20mS, a 5 volt reference signal of opposite polarity to that of the input signal is applied and the length of time it takes to discharge the capacitor to zero volts is directly proportional to $V_{in.}$ When the voltage across the capacitor reaches zero a Null Detector produces a signal to strobe the display circuitry, disconnect the reference voltage and reset the circuit ready for the next measurement cycle.

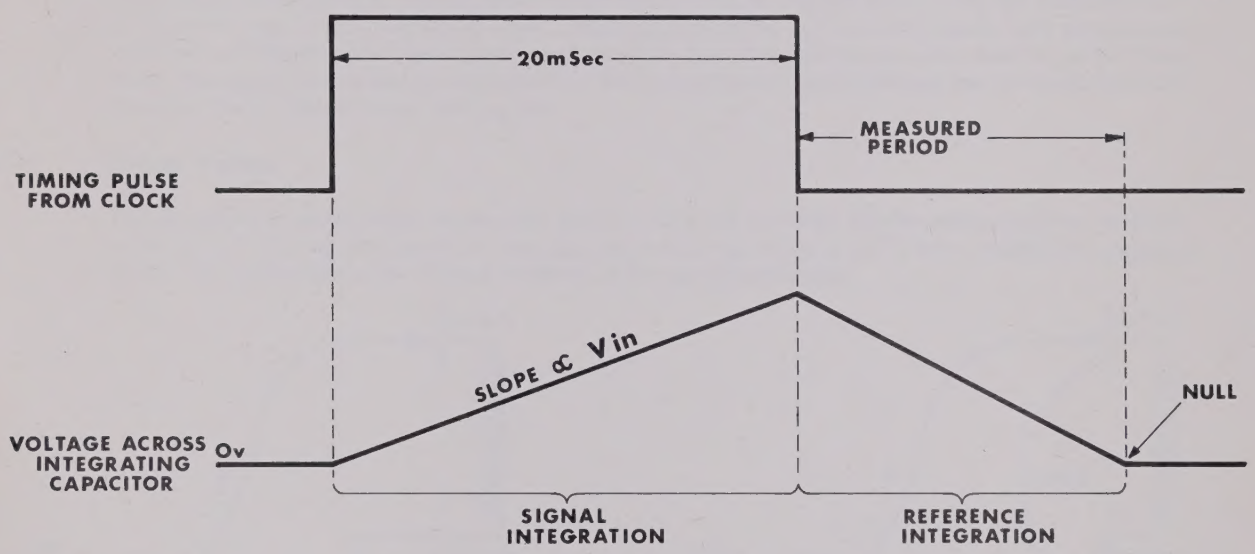

FIG 1.3 MEASUREMENT CYCLE TIMING

SECTION 2

INSTALLATION AND SWITCH-ON

2.1 UNPACKING AND INSPECTION

NOTE: Should the equipment have been subjected to excessive mishandling in transit, the fact will probably be visible as external damage to the shipping carton. Unpack the equipment and check for external damage to cases, pushbuttons, terminals, etc. If any damage is found, notify the carrier immediately.

Every care is taken in the choice of packaging materials to ensure that your new equipment will reach you in perfect condition. The packaging and protection are adequate to cater for all the normal hazards of road or rail transit. Special export packaging is provided for overseas orders.

2.2 INSTALLATION

The instrument is housed in a robust, heavy-gauge aluminium case designed to withstand the rough knocks of industrial usage. Detachable supply leads, comprising two metres of 3-core PVC sheath cable permanently moulded to a fully-shrouded 3-pin cable socket, fit at the rear of the instrument and should be pushed firmly home. The supply lead should be connected to a 3-pin plug (fused 1 amp), ensuring that the instrument case is earthed via the Yellow/Green earthing wire.

2.2.1 Voltage Tappings

The instrument is packed ready for use with 205V to 255V, 48 to 440Hz supplies unless otherwise specified at the time of ordering. For operation from supplies in the range 105V to 127V, 48 to 440Hz, it is necessary to alter the connections to the primary windings of the mains transformer.

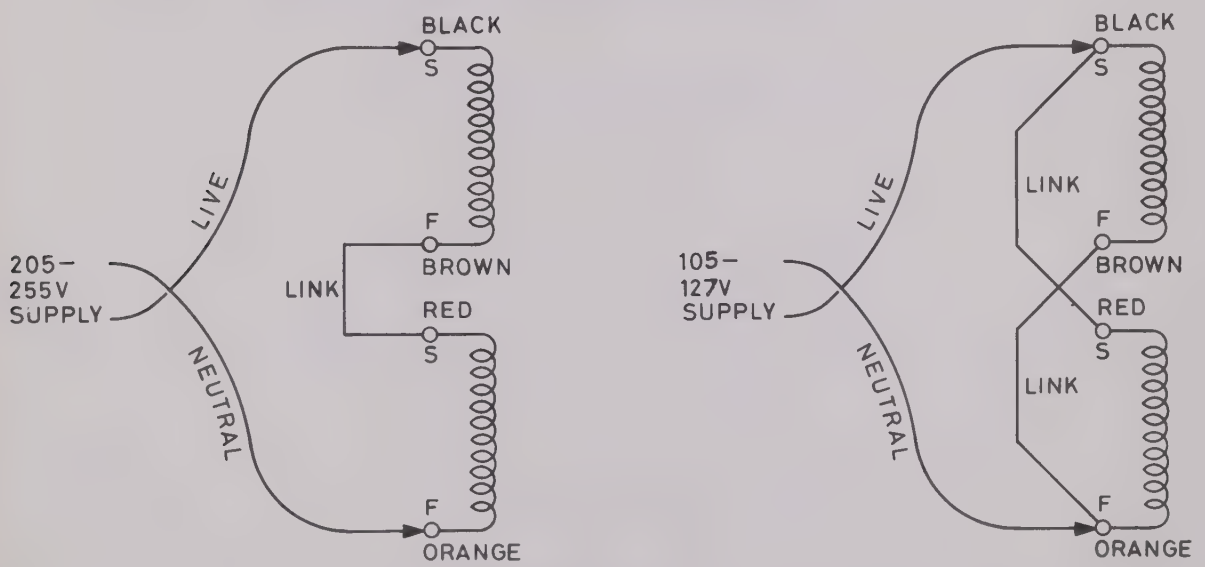

FIG. 2.1

Mains transformer tappings

To change the working voltage, remove the top cover of the instrument and locate the mains transformer in the right hand rear corner of the instrument.

For 205V to 255V operation the Red and Brown wires are connected to a linking post located between the LIVE (Black) and NEUTRAL (Orange) posts.

For 105V to 127V operation the Red wire is connected to the post with the Black wire (LIVE) and the Brown wire is connected to the post with the Orange wire (NEUTRAL).

2.3 SWITCH-ON

(i) Ensure that the instrument is correctly adjusted for the mains supply to which it is to be connected. Unless otherwise specified on order it will have been connected for 205V-255V working. If in doubt check as described in Section 2.2.1.

NOTE: No fine tapping adjustments are required for voltages within each of the major ranges.

(ii) Connect the mains supply lead.

(iii) Switch on the supply and allow the equipment to stabilise. A minimum of 2 hours warm-up should be allowed to reach full specification although the instrument will be operational within a few seconds.

(iv) Before proceeding any further, read Section 3, CONTROLS AND CONNECTIONS and Section 5, OPERATION AND APPLICATIONS.

(v) Zeroing Procedure. With a copper shorting link between the voltage Hi, Lo and guard terminals, adjust the 'pA offset' control for a display of 0.0000 bouncing polarity on the 10V DC range.
Then adjust the 'μV offset' control for 0.000 bouncing polarity on the 100mV D.C. range.
Switch back to 10V range and repeat the procedure until no further adjustments are necessary.

SECTION 3

CONTROLS AND CONNECTIONS

3.1 INTRODUCTION

This section details the manual facilities of the 1057a DMM.

3.2 FRONT PANEL

The locations of the front panel controls are shown in Fig. 1:1.

3.2.1 Power

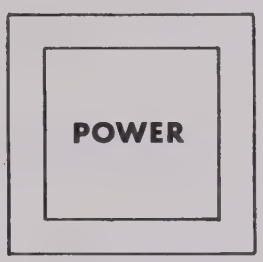

Fig 3.1

This push button switch with alternate ON/OFF action is mounted on the left of the front panel. It isolates the mains supply live from the instrument with the exception of the mains fuse, socket and filter which remain live unless the supply lead is disconnected.

Although no 'Supply On' pilot light is fitted, the circuit is so arranged that when the mains transformer is energized, at least one part of the display will always be glowing, even when no numerals are visible.

3.2.2 Function Controls

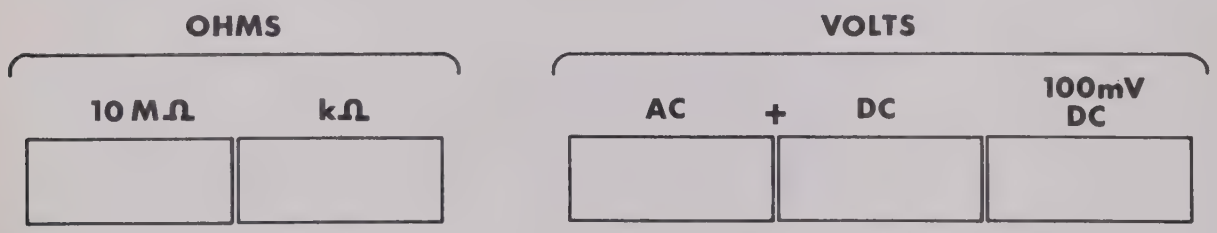

Fig 3.2 Function Controls

The function controls comprise a set of five switches interlocked such that the following functions may be selected. A corresponding indication of the function selected is displayed to the right of the value measured.

100mV DC — Depressing this button cancels the previous function, inhibits all switches in the RANGE group and provides the user with a sensitive DC range enabling the measurement of voltages down to 1μV to be made.

AC/DC — Two buttons are provided for this function, one for DC voltage and the other for R.M.S. AC voltage measurements. They may be selected singly, or in cases when the R.M.S. measurement of an AC voltage with a DC component is required, the switch interlocking allows the two buttons to be depressed simultaneously. In the DC coupled mode the instrument reads $\sqrt{AC^2 + DC^2}$. When either of these buttons is depressed the range is that selected by the appropriate button in the range group.

kΩ Depressing this button cancels the previous function and provides the user with whichever resistance range is selected in the RANGE group.

10MΩ Depressing this button cancels the previous function, inhibits all the switches in the RANGE group and provides the user with a high resistance range enabling the measurement of resistances up to 20MΩ to be made.

3.2.3 Range Controls

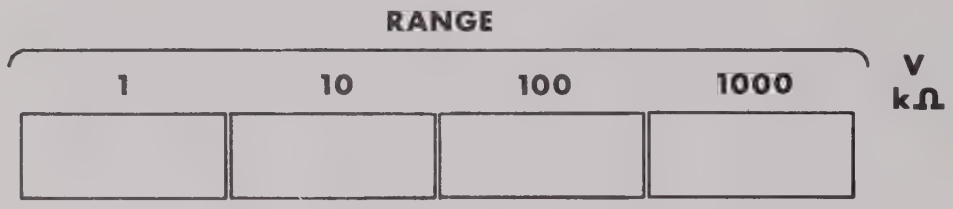

Fig 3.3 Range Controls

The range controls comprise a set of four switches interlocked such that only one may be depressed. They are marked with the full range value.

OVERRANGE is signified by a 1 being illuminated at the left of the normal display. 100% overrange permits a maximum display of 199999 except on the 1kV range where it is limited by a maximum input voltage of 1000.00 volts. OVERLOAD results in blanking of the digits above 100% overrange.

3.2.4 Offset Adjustments

μV OFFSET This screwdriver operated multi-turn preset control enables the instrument to be zeroed with zero input signal applied to the 100mV DC range. The span is approximately ± 50μV and it can then be used very effectively to compensate for external offsets as well as the very low, long term drift of the instrument (See zeroing procedure, Section 2.3(v) or 5.3).

pA OFFSET This screwdriver operated multi-turn preset control enables the input current of the instrument, (typically 30pA), to be minimised on the DC voltage ranges. This control is particularly useful when measuring from very high source resistances. It can be conveniently set up by using it as a 10V DC range zero adjustment with a short-circuited input. (See zeroing procedure, Section 2.3(v) or 5.3).

3.2.5 Input Connections

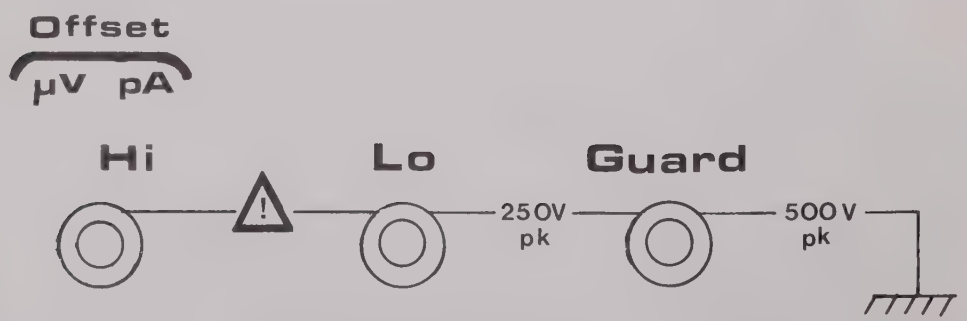

Fig 3.4 1057a Input Connections

Three terminals are located on the front panel marked Volts/Ohms Hi, Lo & Guard, coloured Red, Black and White respectively. The terminals are mounted on a standard 0.75 inch (19mm) spacing and connection may be made using 4mm single or double banana plugs.

In order to minimise thermal E.M.F's, copper wire should be used for connecting to the instrument and preferably passed through the side entry holes of the Hi and Lo terminals, although this precaution is usually only of importance when measuring at microvolt levels.

NOTE: The following input voltages must not be exceeded under any circumstances:–

Volts	Hi to Lo	1000 Volts DC or peak AC.
Ohms	Hi to Lo	250 Volts DC or r.m.s.
Volts/Ohms	Lo to GUARD	250 Volts peak.
GUARD to EARTH		500 Volts peak.

CAUTION: Switching input from +1kV to −1kV may cause damage. It is therefore also inadvisable to change function or range with high voltages applied.

Full details of the recommended methods of making connection between the input terminals and the circuit under test are given in Section 5.6.

3.3 REAR PANEL

3.3.1 Power

POWER SOCKET – a 3 pin CEE regulation 250V, 6A power socket accepts the mating plug which is integrally moulded with the power lead.

POWER FUSE – the supply to the mains transformer primary windings is protected by a 20mm x 5mm glass cartridge, anti-surge type fuse; 160mA rating for 230V operation and 250mA rating for 115V operation.

SECTION 4

SPECIFICATION AND SPECIFICATION VERIFICATION

4.1 SPECIFICATIONS

4.1.1 General

Power Supply	205 - 255 or 105 - 127 volts, 48 - 440 Hz. Specify line frequency and voltage when ordering. Consumption is approximately 12 V A.
Operating Temperature	$0^{o}C$ to $50^{o}C$.
Storage Temperature	$-25^{o}C$ to $+70^{o}C$.
Dimensions	H = 90 mm (3.5"), W = 224 mm (8.8"), D = 343 mm (13.5").
Weight	4 kg (8.8 lbs.)
Rack Mounting	"Ears" mounted on side of instrument.
Specification Validity	For 6 months over $18-28^{o}C$.

4.1.2 D.C. Voltage Measurement

Ranges	100.000 mV, 1.00000 V, 10.0000 V, 100.000 V, 1000.00 V.
Overrange	100% (i.e. 199999 full scale) on all ranges except 1000.00 V.
Accuracy	6 months, $18-28^{o}C$, after mV and pA offset adjustment. All ranges: 0.01% reading ± 0.001% FS ± 1μV. Add 0.15ppm/V above 300V. e.g. at 400V add 0.15ppm x 100.
Temperature Coefficient	± 1/10 (of above accuracy rating)/^{o}C ± 0.5μV/^{o}C. Input offset current drift may add .0002% FS/^{o}C to 10 volt drift specification. This should be compensated for by using the pA offset control.
Stability	After six months use better than 100 ppm per year.
Common Mode Rejection (1kΩ Source Unbalance)	DC > 120 dB AC > 140 dB at 50Hz.
Series Mode Rejection	80 dB at 50Hz increasing at 40 dB/decade.
Settling Time (to .01%)	< 650mS
Read Rate (internal)	2.5/S.
Maximum Input Voltage (without damage)	Signal Hi to Signal Lo 1000 V peak (Any Range). Signal Lo to Guard 250 V peak. Guard to Earth (Case) 500 V peak. CAUTION: Switching input from +1kV to −1kV may cause internal damage. It is therefore also inadvisable to change function or range with high voltages applied.
Input Resistance (Rin)	100mV and 1V ranges (up to 2V) Rin > 10,000 MΩ. 10V to 1,000V ranges Rin = 10 MΩ ± 0.1%.
Input Current	< 50pA drifting at typically 3pA/^{o}C.

4.1.3 AC Voltage Measurement

Ranges	1.00000 Volts, 10.0000 Volts, 100.000 Volts, 1000.00 Volts.
Overrange	100% i.e. 199999 FS except 1000V.
Accuracy	6 months duration, 18–28°C, $< 3 \times 10^6$ Volt Hertz $<$ 1000V peak. DC and 40Hz – 3kHz ± 0.1% reading ± 0.05% FS 3kHz - 30kHz ± 0.2% reading ± 0.1% FS Add 0.2 ppm/V above 300V.
Temperature Coefficient	± 1/10 (above accuracy rating)/°C.
Common Mode Rejection	1kΩ unbalance in Hi $>$ 100 dB @ DC – **60Hz.** 1kΩ unbalance in Lo $>$ 60 dB @ DC – 60Hz.
Settling Time	1 Sec.
Maximum Input Voltage	1000V peak on any range, $< 3 \times 10^6$ Volt. Hertz. Measures AC component with up to 1000V DC bias on any range, (AC coupled).
Conversion Type	True R.M.S. (AC coupled or DC coupled).
Input Impedance	1000MΩ shunted by 150pF on 1V range. 10MΩ shunted by 150pF on other ranges.

4.1.4 Resistance Measurement

Ranges	1.00000kΩ, 10.0000kΩ, 100.000kΩ, 1000.00kΩ, 10.0000MΩ.	
Overrange	100% on all ranges.	
Accuracy	6 months duration 18–28°C. 1kΩ to 100kΩ ± 0.01% reading ± 0.002% FS ± 100mΩ (can be zeroed). 1000kΩ ± 0.03% reading ± 0.002% FS. 10MΩ ± 0.5% reading ± 0.002% FS.	
Temperature Coefficient	± 1/10 (above accuracy rating)/°C.	
Input Protection	250V DC or r.m.s.	
Current Through Unknown	1kΩ	100.000μA
	10kΩ	100.000μA
	100kΩ	10.0000μA
	1000kΩ	1.00000μA
	10MΩ	100.000nA

4.2 SPECIFICATION VERIFICATION

4.2.1 Description

The following steps form a routine for checking that the instrument is working within its specified accuracy where the intention is not to re-calibrate internally. It is thus useful for incoming inspection or routine calibration checks.

It is recommended that due to the wide measurement capability of the instrument, only those aspects of the specification relevant to normal use be verified. This saves considerably in both time and calibration equipment, especially where the 1μV resolution or hf AC performance are not required. For general purpose measurements, the whole procedure should be followed to verify the entire specification.

NOTE: Ideally the specification verification procedure should be carried out with the instrument at 23°C but the specification is valid from 18°C to 28°C. Measurements taken outside this temperature range should take into account the specified temperature coefficients in order to verify the specification.

4.2.2 Equipment Requirements

(i) For DC voltage checks:–

A DC source is required of accuracy at least three times better than the accuracy being verified, from 100mV to 1000V.
Examples:

Julie Research DVS 106.
Optimation AC 126/PA 226 (For AC and DC).

(ii) For AC voltage checks:–

Optimation AC125/PA1182.
Hewlett Packard 745/746.
Optimation AC126/PA 226 (AC and DC).

To verify the performance in the DC coupled mode a voltage source is required capable of producing approximately 1 volt DC.

(iii) for OHMS checks:–

A set of standard resistors is required covering 1kΩ to 10MΩ.

4.2.3 Procedures

Turn on the instrument to be checked and allow a minimum of 2 hours to warm up (see section 2.3, SWITCH-ON).

4.2.3.1 DC Voltage Performance

(i) Zero the instrument by the following procedure:

1. Ensure link is fitted between Guard and Input Volts Lo. Connect Hi to Lo with a short link.
2. Switch the instrument to the 10V DC range and adjust the 'pA' offset control on the front panel of the instrument for 0.0000 bouncing polarity.
3. Switch the instrument to the 100mV DC range and adjust the 'μV' offset contron on the front panel of the instrument for 0.000 bouncing polarity.
4. Repeat steps 2 and 3 until the instrument reads zero in both ranges without further adjustment.

(ii) Switch instrument to 1 volt range. Check the instrument reads .00000 ± .00002.

(iii) Apply +1.00000 volts, check reading is
+1.00000 ± .00012

(iv) Apply –1.00000 volts, check reading is
–1.00000 ± .00012

If (ii) to (iv) are passed this indicates that most of the instrument is working correctly. If it is failed by more than 0.3% then it is likely that there is a fault rather than a calibration error.

(v) Select 10V range Apply +10.0000V, check reading is
+10.0000 ± .0012

(vi) Apply –10.0000V, check reading is
–10,0000 ± .0012

(vii) Select 100V range Apply +100.000V, check reading is
+100.000 ± .012

(viii) Apply –100.000V, check reading is
–100.000 ± .012

(ix) Select 1kV range Apply +1000.00V, check reading is
+1000.00 ± .22

(x) Apply zero voltage input. Apply −1000.00V, check reading is
−1000.00 ± .22

(xi) Select 100mV DC. Turn DC source down to zero. Allow several minutes for thermal e.m.f's to disappear or stabilize.
Adjust μV offset for display of 0.000
Apply +100.000mV, check reading is
+100.000 ± .013

(xii) Apply −100.000mV, check reading is
−100.000 ± .013
(if changing polarity involves reversing leads, check zero again as thermal e.m.f's may have changed. If possible reverse polarity at a higher voltage level so as not to reverse thermals).

This concludes checking of accuracy.

(xiii) For linearity check, select 1 volt range.

Apply +0.10000V, check reading is
+0.10000 ± .00003

(xiv) Apply +0.50000V, check reading is
+0.50000 ± .00007

(xv) Apply +1.00000V, check reading is
+1.00000 ± .00012

(xvi) Apply +1.90000V, check reading is
+1.90000 ± .00021

DC Verification is now complete.

4.2.3.2 **AC Voltage Performance**

(i) Select AC V.

(ii) Connect Hi to Lo with a short link. Check instrument reads 100 digits maximum on all ranges.

(iii) Apply 1.00000 volts r.m.s. at 40Hz, 3kHz, 30kHz in turn. The readings are respectively:−

1.00000 ± .00200

1.00000 ± .00200

1.00000 ± .00400

If this test is failed by more than about .3% at 3kHz or 2% at 30kHz there is probably a fault rather than a calibration error.

(iv) Repeat (iii) for 10V range with 10V r.m.s. input. The readings are:−

10.0000 ± .0200

10.0000 ± .0200

10.0000 ± .0400

(v) Repeat (iii) for the 100V range with 100V r.m.s. input. The readings are:−

100.000 ± .200

100.000 ± .200

100.000 ± .400

(vi) Repeat (iii) for the 1000V range with 700V r.m.s. (1,000V pk) input except at 30kHz which is not specified. The readings are:−

700.00 ± 1.78

700.00 ± 1.78

(vii) To check the DC coupled performance of the instrument it is only necessary to check that it responds equally to positive and negative signals as follows:–

Switch to 1V range and select DCV + ACV
Apply approximately 1 volt DC with positive to Hi and negative to Lo, and note the reading.
Reverse the connections and check that the same reading, within ± 0.00200, is obtained.

4.2.3.3 OHMS Performance

(i) Carry out step 4.2.3.1(i).

(ii) Select kΩ, 1kΩ range, connect Hi to Lo with a short link. Check the instrument reads .00010 maximum.

(iii) Connect the 1kΩ resistor to the input terminals. Check the reading is 1.00000 ± .00024

NOTE: If long leads are used to the resistors these must be accounted for either by nulling out the lead resistance with the 'μV' offset control or by computing the difference between measured readings and measured lead resistance.

(iv) Select 10kΩ, connect the 10kΩ resistor. Check reading is:

10.0000 ± .0015

(v) Select 100kΩ, connect the 100kΩ resistor. Check reading is:

100.000 ± .014

(vi) Select 1,000kΩ, connect the 1,000kΩ resistor. Check reading is:

1000.00 ± .34 (after allowing adequate settling time)

(vii) Select 10MΩ, connect the 10MΩ resistor. Check reading is:

10.0000 ± .0500 (after allowing adequate settling time)

SECTION 5

OPERATION AND APPLICATIONS

5.1 INTRODUCTION

This section is intended as a guide to the use of the instrument and should be read in conjunction with Section 2.3 SWITCH-ON, Section 3 CONTROLS AND CONNECTIONS, with special reference to Section 3.2.5, Input Connections.

5.2 PRELIMINARY CHECKS

1. Check that the instrument is correctly adjusted for the local mains supply voltage, see Section 2.2.1. This will be 230V unless the low voltage version has been specifically requested. No fine tapping adjustment is required within each of the major voltage ranges.

2. Check that correct fuse is fitted, see Section 3.3.1.

3. Check that a suitable plug is correctly connected to the mains lead, i.e.

   BROWN – LIVE
   BLUE – NEUTRAL
   GREEN/YELLOW – EARTH

5.3 DC VOLTAGE MEASUREMENT

1. Switch 'Power on'. If the instrument is not required to work to full accuracy, it may be used immediately. Otherwise, allow at least two hours for the instrument to stabilise.

2. Zero the instrument as follows:–

   2.1 Connect a copper shorting link between the Hi and Lo terminals ensuring that the Lo and Guard are joined with the link provided.

   2.2 Select "VOLTS", "DC" & "RANGE", "10".

   2.3 Adjust "pA offset" control for a display of 0.0000 with bouncing polarity sign.

   2.4 Select "VOLTS", "100mV DC".

   2.5 Adjust "μV offset" control for a display of 0.000 with bouncing polarity sign.

   2.6 Repeat 2.2 to 2.5 until no further adjustments become necessary.

3. Select voltage range as follows:–

   3.1 If the unknown voltage is expected to be greater than 200mV then select "VOLTS", "DC" and an appropriate "RANGE", either "1, 10, 100 or 1000".

   3.2 If the unknown voltage is expected to be less than 200mV then select "VOLTS", "100mV DC"; on this range care must be taken to minimise and balance thermal e.m.f's generated in the leads. The use of steel probes, croc-clips and all metals except copper should be avoided.

4. Select an optimum Guard connection as described in Section 5.6.

5. Connect the input terminals to the unknown voltage source – red to signal high and black to signal low. The maximum continuous input on any DC voltage range is 1kV.

6. Read the voltage on the display. The polarity indicated is that of the Hi terminal with respect to the Lo. If the display is blank, select a higher range.

   For the same input signal the most accurate reading is obtained using the lowest range possible, e.g. If the input signal is +1.80634V, then the reading,

on the 1kV range could be	+	1.82V
and on the 100V range could be	+	1.807V
and on the 10V range could be	+	1.8064V
and on the 1V range could be	+	1.80632V
and on the 100mV range would be	+	mV

The accuracy on each range above can be calculated as follows:–

Specified accuracy on DC volts is ± .01% reading ± .001% FS, which for a reading of 1.8 is ± (.01% x 1.8) ± (.001% x 1.99999).

= ± 0 digits ± 2 digits on 1kV range.

= ± 0 digits ± 2 digits on 100V range.

= ± 2 digits ± 2 digits on 10V range.

= ± 18 digits ± 2 digits on 1V range.

5.4 AC VOLTAGE MEASUREMENT

1. Switch 'Power On'. If the instrument is not required to work to full accuracy, it may be used immediately. Otherwise, allow at least two hours for the instrument to stabilise.

2. Select "VOLTS" "AC". If the AC voltage source has a DC component to be measured then select "VOLTS", "AC" and "DC". The reading in step 6 will then be

$$\sqrt{(\text{AC component})^2 + (\text{DC component})^2}$$

3. Select a "RANGE" appropriate to the expected unknown voltage source either "1, 10, 100 or 1000".

4. Select an optimum Guard connection as described in Section 5.6.

5. Connect the input terminals to the unknown voltage source – red to signal high and black to signal low. The maximum continuous input Hi to Lo on AC volts on any range is 1000V peak or 700V r.m.s. sine wave, 250V peak Lo to Guard and 500V peak Guard to earth.

6. Read the voltage on the display. If the display is blank then select a higher range. For the same input signal the most accurate reading is obtained on the lowest range possible, e.g.

   If the input signal is 18.0634V at 50Hz, then the reading,

on 1kV range could be	18.06V
and on 100V range could be	18.100V
and on 10V range could be	18.0654V
and on 1V range would be	V

The accuracy on each of the above ranges may be calculated as in Section 5.3.6.

5.5 RESISTANCE MEASUREMENT

1. Switch 'Power On'. If the instrument is not required to work to full accuracy, it may be used immediately. Otherwise, allow at least two hours for the instrument to stabilise.

2. Zero the instrument as for "DC Voltage Measurement" Section 5.3.2.

3. Connect input leads to the Hi and Lo terminals.

4. Short together the input leads.

5. Select "OHMS", "kΩ".

6. Select a resistance range as follows:-

   6.1 If the unknown resistance is expected to be less than 2MΩ, then select "OHMS" "kΩ" and an appropriate "RANGE" either "1, 10, 100 or 1000".

   6.2 If the unknown resistance is expected to be greater than 2MΩ, then select "OHMS", "10MΩ".

7. Select the optimum Guard connection as described in Section 5.6

8. Note the reading, i.e. the resistance of the input leads.

9. Connect the input leads to the unknown resistance. A maximum of 19.9999MΩ can be measured.

10. Read the resistance on the display. Subtract the resistance of the input leads measured in 5.5.8; if significant. If the display is blank, then select a higher range. For the same resistance the most accurate reading is obtained using the lowest range possible, e.g.

If the resistance to be measured is 12.5862kΩ, then the reading,

on 10MΩ range could be	0.0127MΩ
and on 1000kΩ range could be	12.60kΩ
and on 100kΩ range could be	12.589kΩ
and on 10kΩ range could be	12.5865kΩ
and on 1kΩ range would be	kΩ

The accuracy on each of the above ranges may be calculated as in Section 5.3.6.

5.6 COMMON MODE AND GUARD

Common Mode Voltages are equally present on both terminals of the voltage source being measured and excessive levels, either AC or DC, can affect the measurement being made. However, sensible use of the GUARD terminal can reduce errors to a negligible level.

NOTE: In most measurement situations it is adequate to strap together the Lo and Guard terminals by use of the link provided and to connect the source as shown in Fig. 4:1.

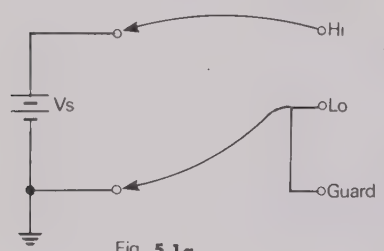

Fig **5.1a**

The disadvantage of the simple arrangement in Fig. 5:1(a) is that the connecting leads form a loop. If a stray alternating magnetic field from the mains transformer of a neighbouring instrument passes through the loop it will behave as a single turn secondary winding, and unwanted AC voltages will be induced into the measuring circuit.

The GUARD terminal should be used when the source to be measured presents an unbalanced impedance to the measuring terminals and Common Mode Voltages are present. In general, regardless how the Hi and Lo terminals are connected, the GUARD terminal should refer to the source of Common Mode Voltage as shown in Figs. 5:1(b). (c), (d) and (e).

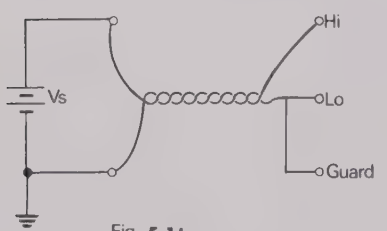

Fig **5.1b**

Fig. 5:1(b) is a better arrangement, where the twisted pair reduces the loop area and adjacent twists of the wires produce cancellation of any induced voltages.

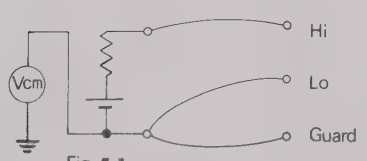

Fig **5.1c**

The simple case in Fig. 5:1(c) allows the GUARD to be connected remotely or at the terminals since in both cases it is to the source of Command Mode Voltages.

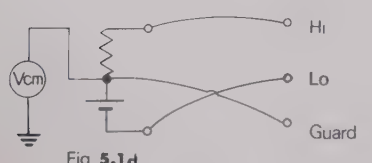

Fig **5.1d**

Fig. 5:1(d) shows a case where the Common Mode Voltage is not present on the Lo measurement terminal and should therefore be connected remotely.

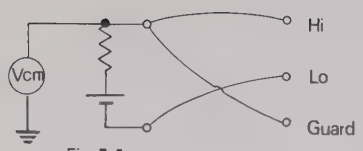

Fig 5.1e

Fig. 5:1(e) shows an extreme situation where all the unbalance to Common Mode Voltage is in the Lo lead and GUARD must therefore be connected to Hi.

The cases above show the connections made by use of individual wires. It is recommended, however, that a screened twisted pair microphone cable be used with the GUARD terminal connected to the screen. Table 5.2 below lists the recommended types.

TABLE 5:2 RECOMMENDED INPUT CABLES

Manufacture	Type	pF/Metre	Outside diameter
Suhner	G03939	65	4.6 mm
Suhner	CB04730	195	5.3 mm
Transradio	MC 02-A	115	4.4 mm
Transradio	MC 02-D	130	3.5 mm
B.I.C.C.	9442 Y	120	4.7 mm

When making a particular measurement, choose the most suitable method of connection and check that it does not involve exceeding any of the input voltages listed under Section 3.2.5.

5.7 THERMAL E.M.F.

Where very low level measurements are being made, care must be taken to minimise and balance thermal e.m.f. generated in the leads. In general, the use of steel probes, croc-clips and all metals with the exception of copper is to be avoided.

ADDENDUM AND ERRATA SHEETS INDEX

INSTRUMENT:

SERIAL NO:

COMPONENT PARTS AND SERIAL NOS.	ASSOCIATED UPDATE SHEETS

ERRATA SHEETS:

datron

TO: THE USER

Every effort has been made to ensure that the information supplied with the instrument is accurate and up to date. If, however, you find any errors or have any suggestions for improving this Manual, please return the reply card completed as appropriate.

Full information is available on the complete range of Datron products and we will be pleased to forward these to you on request by return of the reply card completed as appropriate.

Name:

Dept:

Company:

Address

Instrument:

Serial No:

Manual Ref. No.:

Correction / Suggestion:

Please send information on the following products:--

Model 1030	True RMS Digital Voltmeter	☐
Model 1041	4½ digit Multifunction Digital Voltmeter	☐
Model 1045	4½ digit DC Digital Voltmeter	☐
Model 1051	5½ digit Precision Multifunction Digital Voltmeter	☐
Model 1055	5½ digit DC Digital Voltmeter	☐
Model 1057	5½ digit Digital Multimeter.	☐
Model 1059	5½ digit Digital Multimeter.	☐
Data Logging Equipment		☐

MP MASTER
MA23500